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EXAMINER

NASH, LASHANYA RENEE

ART UNIT PAPER NUMBER

2153

DATE MAILED: 06/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/909,739

Applicant(s)

MATE ET AL.

Examiner

LaShanya R. Nash

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on March 16, 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-67 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7, 14-32, 35-55 and 58-67 is/are rejected.
- 7) ☒ Claim(s) 8, 9, 33, 34, 56, and 57 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This action is in response to an Amendment filed March 16, 2005. Claims 1-67 are presented for further consideration.

Response to Arguments

Claim rejection, see Remarks, with respect to claim 32, under 35 USC 112, second paragraphs are withdrawn.

Applicant's arguments, see Remarks, filed March 16, 2005 have been fully considered but are not persuasive.

In considering the Applicant's arguments the following factual remarks are noted:

- (I) Applicant contends that Ramankutty does not disclose or suggest the first partition includes indices having highest priority ranging from a lowest index to a partition index and the second partition includes indices having a lowest priority ranging from a highest index to the partition index.
- (II) Applicant contends that Ramankutty does not disclose or suggest indices are partitioned into one or more logical partitions.
- (III) Applicant contends that Ramankutty does not disclose or suggest loading TCAM entries in a predetermined order.
- (IV) Applicant contends that subsequent dependent claims should be found allowable as applied addition references (as set forth in the office action) fail to cure the aforementioned deficiencies in Ramankutty.

In considering (I), Applicant contends that the TCAM method and system disclosed by Ramankutty fails to disclose or suggest the first partition includes indices having highest priority ranging from a lowest index to a partition index and the second partition includes indices having a lowest priority ranging from a highest index to the partition index. Examiner respectfully disagrees. Examiner asserts that Ramankutty expressly discloses the first partition (i.e. prefix length group V; Figure 1) of the TCAM includes indices ranging from lowest index (i.e. grp_add_current; Figure 1) to a partition index (group_add_base; Figure 1) and the second partition (i.e. prefix length group W; Figure 1) including indices ranging from a highest index (i.e. grp_add_current; Figure 1) to the partition index (group_add_base; Figure 1). Ramankutty further discloses that priority can be established based on the order (i.e. prefix length) of the entries within the TCAM (e.g. an entry with a lower address will have a higher priority; column 6, lines 22-30). This priority is subsequently applied to generate an associated priority index value (column 2, lines 40-58). Therefore, the aforementioned TCAM indices as disclosed by Ramankutty are prioritized. As a result, the examiner maintains that Ramankutty discloses: partitioning a ternary content addressable memory (TCAM) into at least a first partition and a second partition (i.e. group); said first partition includes indices having highest priority ranging from a lowest index to a partition index (i.e. base address) and said second partition includes indices having lowest priority ranging from a highest index to said partition index, (column 4, lines 36-53; column 6, lines 10-55; column 2, lines 43-58), as set forth below in the office action.

In considering (II), Applicant contends that Ramankutty does not disclose or suggest indices are partitioned into one or more logical partitions. Examiner respectfully disagrees. Examiner asserts that Ramankutty expressly discloses the indices of TCAM are partitioned into one or more logical partitions (Figure 1, items 108-1, 108-2, 108-3, 108-4, 108-5). Specifically, Ramankutty discloses that the TCAM physical address values correspond to particular prefix lengths. A TCAM address can be a base address for a give group of TCAM entries, and addresses are incremented to provide the next free address for a given partition, (column 3, line 53 to column 4, line 53). Therefore, the aforementioned TCAM indices as disclosed by Ramankutty are logically partitioned based on groups of entries having predetermined prefix lengths. As a result, examiner maintains that Ramankutty discloses: partitioning a ternary content addressable memory (TCAM) into at least a first partition and a second partition (i.e. group); said first partition includes indices having highest priority ranging from a lowest index to a partition index (i.e. base address) and said second partition includes indices having lowest priority ranging from a highest index to said partition index, (column 4, lines 36-53; column 6, lines 10-55; column 2, lines 43-58), as set forth below in the office action.

In considering (III), Applicant contends that Ramankutty does not disclose or suggest loading TCAM entries in a predetermined order. Examiner respectfully disagrees. Examiner asserts that Ramankutty expressly discloses a series of data value entries loaded into TCAM based on predetermined prefix lengths, (column 4, lines 5-53; column 6, lines 3-30). The prefix lengths of the data values are a predetermined order for the aforementioned entries. Therefore, the TCAM as disclosed by Ramankutty, loads

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entries in a predetermined order (i.e. predetermined prefix length). As a result, Examiner maintains that Ramankutty discloses: loading one or more first flow TCAM entries of a first of said plurality of data flows into said first partition in a predetermined order; loading one or more second TCAM entries of a second of said plurality of data flows into said second partition in a predetermined order (i.e. prefix length), (column 4, lines 36-53; column 6, lines 10-30; column 2, lines 43-58), as set forth below in the office action.

In considering (IV), Applicant contends that subsequent dependent claims should be found allowable as additionally applied references (as set forth in the office action) fail to cure the aforementioned deficiencies in Ramankutty. Examiner maintains Ramankutty discloses limitations of rejected claims, as discussed regarding (I), (II), and (III). As a result, Examiner maintains that Ramankutty in view of additional references (as set forth in the office action) disclose and suggest the further limitations recited in the subsequent dependent claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States

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only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1,6,17, 25, 26 and 50-51 are rejected under 35 U.S.C. 102(e) as being anticipated by Ramankutty (US Patent 6,502,163), hereinafter referred to as Ramankutty.

In reference to claims 1, Ramankutty discloses a method for ordering entries in a ternary content addressable memory, based on longest prefix matching, (column 3, line 52 to column 4, line 18). Ramankutty explicitly discloses:

- A method for classifying a plurality of data flows (i.e. packets) in a router comprising the steps of, (column 1, lines 12-26; column 1, lines 37-55; column 3, line 52 to column 4, line 18):
 - Partitioning a ternary content addressable memory (TCAM) into at least a first partition and a second partition (i.e. group); said first partition includes indices having highest priority ranging from a lowest index to a partition index (i.e. base address) and said second partition includes indices having lowest priority ranging from a highest index to said partition index, (column 4, lines 36-53; column 6, lines 10-55; column 2, lines 43-58);
 - Loading one or more first flow TCAM entries of a first of said plurality of data flows into said first partition in a predetermined order; loading one or more second TCAM entries of a second of said plurality of data flows into said second partition in a

- predetermined order (i.e. prefix length), (column 4, lines 36-53;
column 6, lines 10-30; column 2, lines 43-58);
- Setting bit values of a corresponding mask for each of said first TCAM entries and said second TCAM entries such that bits of said respective first TCAM entries and said second TCAM entries are individually masked by said masks, (column 5, lines 23-39 and column 2, lines 22-34);
 - And comparing a prefix comprising predetermined packet header information of an incoming packet to said loaded one or more first TCAM entries and one or more second TCAM entries such that a matching said one or more first TCAM entries subsumes any matching said one or more second TCAM entries, (column 2, lines 13-61; column 1, lines 11-35; column 3, line 62 to column 4, line 5; column 6, lines 10-30).

In reference to claim 25, Ramankutty discloses a method for ordering entries in a ternary content addressable memory based on longest prefix matching, (column 3, line 52 to column 4, line 18). Ramankutty further discloses the method employs an associated CAM index space (column 4, lines 11-22). Ramankutty explicitly discloses:

- A method for classifying a plurality of data flows (i.e. packets) in a router comprising the steps of, (column 1, lines 12-26; column 1, lines 37-55; column 3, line 52 to column 4, line 18):

- Partitioning a ternary content addressable memory (TCAM) into at least a first partition and a second partition (i.e. group); said first partition includes indices having highest priority ranging from a lowest index to a partition index (i.e. base address) and said second partition includes indices having lowest priority ranging from a highest index to said partition index, (column 4, lines 36-53; column 6, lines 10-55; column 2, lines 43-58);
- Loading one or more first flow TCAM entries of a first of said plurality of data flows into said first partition in a predetermined order; loading one or more second TCAM entries of a second of said plurality of data flows into said second partition in a predetermined order (i.e. prefix length), (column 4, lines 36-53; column 6, lines 10-30; column 2, lines 43-58);
- Setting bit values of a corresponding mask for each of said first TCAM entries and said second TCAM entries such that bits of said respective first TCAM entries and said second TCAM entries are individually masked by said masks, (column 5, lines 23-39 and column 2, lines 22-34; column 7, lines 58-67); and
- Comparing a prefix comprising predetermined packet header information of an incoming packet to said loaded one or more first TCAM entries and one or more second TCAM entries such that a matching said one or more first TCAM entries subsumes any

matching said one or more second TCAM entries, (column 2, lines 13-61; column 1, lines 11-35; column 3, line 62 to column 4, line 5; column 6, lines 10-30);

- Maintaining a flow index space having entries corresponding to said TCAM; and determining said predetermined order of said first TCAM entries and said predetermined order of said second TCAM entries in said flow index space before said steps of loading said one or more first TCAM entries, (column 4, lines 19-22; column 5, lines 40-59; column 5, lines 10-19; column 40-59; column 6, line 56 to column 7, line 18; and column 2, lines 50-58).

In reference to claim 26, Ramankutty discloses a routing system (i.e. Figure 1) comprising a ternary content addressable memory, that orders entries based on longest prefix matching, (column 3, line 52 to column 4, line 18 and column 1, lines 36-55).

Ramankutty explicitly discloses:

- A system for classifying a plurality of data flows (i.e. packets) in a router comprising, (column 1, lines 12-26; column 1, lines 37-55; column 3, line 52 to column 4, line 18)
 - Means for (i.e. Figure 1-item 104) partitioning a ternary content addressable memory (TCAM) into at least a first partition and a second partition, said first partition (i.e. base address) includes indices having highest priority ranging from a lowest index to a

- partition index and said second partition includes indices having lowest priority ranging from a highest index to said partition index, (column 5, lines 39-59; column 4, lines 36-53; column 6, lines 10-55; column 2, lines 43-58);
- Means for (Figure 1-item 104) loading one or more first flow TCAM entries of a first of said plurality of data flows into said first partition in a predetermined order; means for (Figure 1-item 104) loading one or more second TCAM entries of a second of said plurality of data flows into said second partition in a predetermined order, (column 5, lines 39-59; column 4, lines 36-53; column 6, lines 10-30; column 2, lines 43-58);
 - Means for (Figure 1-item 100) setting bit values of a corresponding mask for each of said first TCAM entries and said second TCAM entries such that bits of said respective first TCAM entries and said second TCAM entries are individually masked by said masks, (column 5, lines 23-39 and column 2, lines 22-34; column 7, lines 58-67); and
 - Means for (Figure 1-item 100) comparing a prefix comprising packet header information of in incoming packet to predetermined said loaded one or more first TCAM entries and one or more second TCAM entries, wherein a matching said one or more first TCAM entries subsumes an matching said one or more second

TCAM entries, (column 2, lines 13-61; column 1, lines 11-35;
column 3, line 62 to column 4, line 5; and column 6, lines 10-30).

In reference to claim 50, Ramankutty discloses a routing system (i.e. Figure 1) comprising a ternary content addressable memory, that orders entries based on longest prefix matching, (column 3, line 52 to column 4, line 18 and column 1, lines 36-55).

Ramankutty explicitly discloses:

- A system for classifying a plurality of data flows (i.e. packets) in a router comprising, (column 1, lines 12-26; column 1, lines 37-55; column 3, line 52 to column 4, line 18):
 - Means for (i.e. Figure 1-item 104) partitioning a ternary content addressable memory (TCAM) into at least a first partition and a second partition, said first partition includes indices having highest priority ranging from a lowest index to a partition index (i.e. base address) and said second partition includes indices having lowest priority ranging from a highest index to said partition index, (column 5, lines 39-59; column 4, lines 36-53; column 6, lines 10-55; column 2, lines 43-58);
 - Means for (Figure 1-item 104) loading one or more first flow TCAM entries of a first of said plurality of data flows into said first partition in a predetermined order; means for (Figure 1-item 104) loading

- one or more second TCAM entries of a second of said plurality of data flows into said second partition in a predetermined order, (column 5, lines 39-59; column 4, lines 36-53; column 6, lines 10-30; column 2, lines 43-58);
- Means for (Figure 1-item 100) setting bit values of a corresponding mask for each of said first TCAM entries and said second TCAM entries such that bits of said respective first TCAM entries and said second TCAM entries are individually masked by said masks, (column 5, lines 23-39 and column 2, lines 22-34; column 7, lines 58-67); and
 - Means for (Figure 1-item 100) comparing a prefix comprising packet header information of in incoming packet to predetermined said loaded one or more first TCAM entries and one or more second TCAM entries, wherein a matching said one or more first TCAM entries subsumes an matching said one or more second TCAM entries, (column 2, lines 13-61; column 1, lines 11-35; column 3, line 62 to column 4, line 5; and column 6, lines 10-30); and
 - Means for (Figure 3) maintaining a flow index space having entries corresponding to said TCAM; and determining said predetermined order of said first TCAM entries and said predetermined order of said second TCAM entries in said flow index space before said

steps of loading said one or more first TCAM entries, (column 4, lines 19-22; column 5, lines 40-59; column 5, lines 10-19; column 40-59; column 6, line 56 to column 7, line 18; and column 2, lines 50-58).

All subsequent system claims are discussed with the associated method and apparatus claims.

In reference to claim 51, Ramankutty discloses an apparatus (i.e. Figure 1) comprising a ternary content addressable memory, that orders entries based on longest prefix matching, (column 3, line 52 to column 4, line 18). Ramankutty explicitly discloses:

- An apparatus for classifying a plurality of data flows in a routing system comprising, (column 1, lines 12-26; column 1, lines 37-55; column 3, line 52 to column 4, line 18):
 - A ternary content addressable memory (TCAM) (Figure 1-item 102), (column 5, lines 11-30);
 - A partitioning algorithm (i.e. logic) for partitioning said TCAM into at least a first partition and a second partition, said first partition includes indices having highest priority ranging from a lowest index to a partition index and said second partition includes indices having lowest priority ranging from a highest index to said partition index, (column 5, lines

39-59; column 4, lines 36-53; column 6, lines 10-55; column 2, lines 43-58);

- A loading algorithm (i.e. logic) for selecting a respective mask value to structure one or more first flow TCAM entries of a first of said data flows and one or more second flow TCAM entries and said respective mask values into said second partition, (column 5, lines 23-39 and column 2, lines 22-34; column 7, lines 58-67); and
- A search algorithm (i.e. logic) for performing an associative comparison of a prefix comprising predetermined packet header information of an incoming packet to said loaded one or more first flow TCAM entries and one or more second TCAM entries of a first of said plurality of data flows into said first partition in a predetermined order such that a matching said one or more first TCAM entries subsumes an matching said one or more second TCAM entries, (column 2, lines 13-61; column 1, lines 11-35; column 3, line 62 to column 4, line 5; and column 6, lines 10-30).

All subsequent apparatus claims are discussed with the associated method and system claims.

In reference to claims 6,31, and 54, Ramankutty explicitly discloses the limitations, (column 4, lines 19-22; column 5, lines 40-59; column 5, lines 10-19; column

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40-59; column 6, line 56 to column 7, line 18; column 2, lines 50-58; column 6, lines; and Figure 3).

In reference to claims 17, 42, and 61, Ramankutty explicitly discloses the limitations, (column 6, lines 3-30 and column 2, lines 40-49).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 24 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty (US Patent 6,502,163), in view of Pereira (US Patent 6,324,087) and Hawkins (US Patent Application Publication 2002/0078040) hereinafter referred to as Ramankutty, Pereira, and Hawkins.

In reference to claim 24, Ramankutty discloses a method for ordering entries in a ternary content addressable memory, based on longest prefix matching, (column 3, line 52 to column 4, line 18). Ramankutty explicitly discloses:

- A method for classifying a plurality of data flows (i.e. packets) in a router comprising the steps of, (column 1, lines 12-26; column 1, lines 37-55; column 3, line 52 to column 4, line 18):
 - Partitioning a ternary content addressable memory (TCAM) into at least a first partition and a second partition (i.e. group); said first partition includes indices having highest priority ranging from a lowest index to a partition index (i.e. base address) and said second partition includes indices having lowest priority ranging from a highest index to said partition index, (column 4, lines 36-53; column 6, lines 10-55; column 2, lines 43-58);
 - Loading one or more first flow TCAM entries of a first of said plurality of data flows into said first partition in a predetermined order; loading one or more second TCAM entries of a second of said plurality of data flows into said second partition in a predetermined order (i.e. prefix length), (column 4, lines 36-53; column 6, lines 10-30; column 2, lines 43-58);
 - Setting bit values of a corresponding mask for each of said first TCAM entries and said second TCAM entries such that bits of said respective first TCAM entries and said second TCAM entries are individually masked by said masks, (column 5, lines 23-39 and column 2, lines 22-34);

- And comparing a prefix comprising predetermined packet header information of an incoming packet to said loaded one or more first TCAM entries and one or more second TCAM entries such that a matching said one or more first TCAM entries subsumes any matching said one or more second TCAM entries, (column 2, lines 13-61; column 1, lines 11-35; column 3, line 62 to column 4, line 5; column 6, lines 10-30).

However, Ramankutty fails to explicitly show the aforementioned TCAM ordering method wherein the first of the plurality of data flows are MPLS or IP-VPN flows.

Nonetheless, this would have been an obvious modification to the method as disclosed by Ramankutty for one of ordinary skill in the art at the time of the invention, as further evidenced by Pereira.

In an analogous art, Pereira discloses a method for partitioning TCAM based on class or type of data stored in the partition for subsequent routing, (column 1, lines 54-64 and column 4, lines 15-29). Pereira further discloses storing IP-VPN flows in TCAM partitions, (column 4, line 58 to column 6, line 13). This modification would have been obvious because one of ordinary skill in the art would have been so motivated to implement this method in the aforementioned TCAM ordering method so as to employ selective searching across partitions of CAM blocks according to flow class, and thereby reducing the power consumption on selective compare operations, (Pereira column 2, lines 13-17).

However, Ramankutty and Pereira fail to show the method wherein the second plurality of data flows is policy based routing flows. Nonetheless, this would have been an obvious modification to the method as disclosed by Ramankutty and Pereira for one of ordinary skill in the art at the time of the invention, as further evidenced by Hawkinson.

In another analogous art Hawkinson discloses a method for classifying policy flows received by communication devices within a network, (column 4, lines 33-34; column 6, line 57 to column 7, line 7; column 14, lines 50-63; Figure 4-item 334 and Table 2). This modification would have been obvious because one of ordinary skill in the art would have been so motivated to implement this method in the aforementioned TCAM ordering method so as to employ selective searching across partitions of CAM blocks according to flow class, and thereby reducing the power consumption on selective compare operations, (Pereira column 2, lines 13-17).

In reference to claim 49, discloses a routing system employed for classifying packets transmitted within a network according to prefix length, via partitioning associated entries in a Ternary Content Addressable Memory (TCAM), (column 3, line 53 to column 4, line 4; column 1, lines 24-55; and Figure 1). Ramankutty explicitly discloses:

- A method for classifying a plurality of data flows (i.e. packets) in a router comprising the steps of, (column 3, line 52 to column 4, line 18; column 1, lines 12-26; and column 1, lines 37-55):

- Partitioning a ternary content addressable memory (TCAM) into at least a first partition and a second partition, (column 4, lines 36-53; column 6, lines 31-55 and column 2, lines 43-58);
- The first partition includes indices having highest priority ranging from lowest index to a partition index (i.e. base address) and the second partition includes indices having lowest priority ranging from the highest index to the partition index, (column 4, lines 36-53; column 6, lines 31-55 and column 2, lines 43-58);
- Loading one or more first flow TCAM entries of a first of the plurality of data flows into the first partition in a predetermined order (i.e. prefix length), (column 4, lines 36-53; column 6, lines 31-55 and column 2, lines 43-58);
- Loading one or more second flow TCAM entries of a second of the plurality of data flows into the second partition in a predetermined order, (column 4, lines 36-53; column 6, lines 31-55 and column 2, lines 43-58);
- Setting bit values of a corresponding mask for each of the first TCAM entries and the second TCAM entries such that bits of the respective first TCAM entries and the second TCAM entries are individually masked by the mask, (column 5, lines 23-39 and column 2, lines 18-34); and
- Comparing a prefix comprising predetermined packet header information of an incoming packet to the loaded one or more first TCAM entries and one or more second TCAM entries such that a matching the one or more

first TCAM entries subsumes any matching the one or more second TCAM entries, (column 3, line 62 to column 4, line 5; column 6, lines 3-55; and column 2, lines 13-61; and column 1, lines 11-35).

However, Ramankutty fails to explicitly show the aforementioned TCAM ordering method wherein the first of the plurality of data flows are MPLS or IP-VPN flows. Nonetheless, this would have been an obvious modification to the method as disclosed by Ramankutty for one of ordinary skill in the art at the time of the invention, as further evidenced by Pereira.

In an analogous art, Pereira discloses a method for partitioning TCAM based on class or type of data stored in the partition for subsequent routing, (column 1, lines 54-64 and column 4, lines 15-29). Pereira further discloses storing IP-VPN flows in TCAM partitions, (column 4, line 58 to column 6, line 13). This modification would have been obvious because one of ordinary skill in the art would have been so motivated to implement this method in the aforementioned TCAM ordering method so as to employ selective searching across partitions of CAM blocks according to flow class, and thereby reducing the power consumption on selective compare operations, (Pereira column 2, lines 13-17).

However, Ramankutty and Pereira fail to show the method wherein the second pluralities of data flows are policy based routing flows. Nonetheless, this would have been an obvious modification to the method as disclosed by Ramankutty and Pereira for one of ordinary skill in the art at the time of the invention, as further evidenced by Hawkinson.

In another analogous art Hawkinson discloses a method for classifying policy flows received by communication devices within a network, (column 4, lines 33-34; column 6, line 57 to column 7, line 7; column 14, lines 50-63; Figure 4-item 334 and Table 2). This modification would have been obvious because one of ordinary skill in the art would have been so motivated to implement this method in the aforementioned TCAM ordering method so as to employ selective searching across partitions of CAM blocks according to flow class, and thereby reducing the power consumption on selective compare operations, (Pereira column 2, lines 13-17).

Claims 2, 27, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty as applied to claims above, in view of Pereira (US Patent 6,324,087) hereinafter referred to as Pereira.

In reference to claims 2, 27, and 52 although Ramankutty explicitly discloses substantial features of the claimed invention the reference fails to disclose a method, system, and apparatus wherein the first plurality of data flows are MPLS or IP-VPN flows. Nonetheless, this would have been an obvious modification to the method, system, and apparatus as disclosed by Ramankutty for one of ordinary skill in the art at the time of the invention, as further evidenced by Pereira.

In an analogous art, Pereira discloses partitioning TCAM based on class or type of data stored in the partition for subsequent routing, (column 1, lines 54-64 and column 4, lines 15-29). Pereira further discloses storing IP-VPN flows in TCAM partitions, (column 4, line 58 to column 6, line 13). This modification would have been obvious

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because one of ordinary skill in the art would have been so motivated to implement this method in the aforementioned TCAM ordering method, system, and apparatus so as to employ selective searching across partitions of CAM blocks according to flow class, and thereby reducing the power consumption on selective compare operations, (Pereira column 2, lines 13-17).

Claims 3-5,18,20, 28-30,43,45, 53, 62 and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty as applied to claims above, and further in view of Hawkinson (US Patent 6,295,532), hereinafter referred to as Hawkinson.

In reference to claims 3, 28, and 53 although Ramankutty explicitly discloses substantial features of the claimed invention the reference fails to disclose a method, system, and apparatus wherein the second plurality of data flows are policy based routing flows. Nonetheless, this would have been an obvious modification to the method as disclosed by Ramankutty for one of ordinary skill in the art at the time of the invention, as further evidenced by Hawkinson.

In an analogous art, Hawkinson discloses a method for classifying policy flows received by communication devices within a network, (column 4, lines 33-34; column 6, line 57 to column 7, line 7; column 14, lines 50-63; Figure 4-item 334 and Table 2). This modification would have been obvious because one of ordinary skill in the art would have been so motivated to implement this modification in the aforementioned TCAM

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ordering method, system, and apparatus so as to employ selective searching across partitions of CAM blocks according to flow class, and thereby reducing the power consumption on selective compare operations, (Pereira column 2, lines 13-17).

In reference to claims 4-5, and 29-30 Ramankutty and Hawkinson show the claimed limitations, (Hawkinson column 4, line 66 to column 5, line 46).

In reference to claims 18, 43, and 62 Ramankutty and Hawkinson show the claimed limitations, (Ramankutty column 6, lines 3-30 and column 2, lines 40-49).

In reference to claims 20, 45, and 64 Ramankutty and Hawkinson show the claimed limitations, (Ramankutty column 2, lines 50-58, column 4, lines 19-22; column 5, lines 40-59; column 5, lines 10-19; column 6, line 56 to column 7, line 9).

Claims 7, 32, and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty and Pereira as applied to claims above, an further in view of Kaiserwerth et al. (US Patent 5,684,954), hereinafter referred to as Kaiserwerth.

In reference to claim 7, 32, and 55 although Ramankutty and Pereira show substantial features of the claimed invention, the references fail to show method, system, and apparatus wherein the MPLS or IP-VPN flows are classified by connection index (CIX) and destination address (DA), CIX only or DA only. Nonetheless, these

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aforementioned limitations were well known in the art at the time of the invention, as further evidenced by Kaiserwerth. Therefore, these would have been obvious modifications to the aforementioned method, system, and apparatus as disclosed by Ramankutty and Pereira.

In an analogous art, Kaiserwerth discloses processing various fields of a protocol header of data streams stored in CAM by a connection identifier and destination address, and connection address only for subsequent transmission in a network, (column 9, lines 39-60 and column 1, lines 8-11). This modification would have been obvious because one of ordinary skill in the art would have been so motivated to implement this modification in the aforementioned TCAM ordering method, system, and apparatus so as to provide a fast and reliable processing of addressing and connection information of data streams, and thereby increasing efficiency (Kaiserwerth column 2, lines 59-61).

Claims 14-15, 35, 40, and 58-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty, Pereira and Kaiserwerth as applied to claims above, and further in view of Brodnik et al. (US Patent 6,266,706), hereinafter referred to as Brodnik.

In reference to claims 14-15, 35, 40, and 58-59 Ramankutty, Pereira and Kaiserwerth show substantial features of the claimed invention, specifically maintaining a flow index space having entries corresponding to the TCAM, (Ramankutty column 2, lines 50-58, column 4, lines 19-22; column 5, lines 40-59), and assigning flow classified

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by CIX and DA or CIX only, (Kaiserwerth column 9, lines 39-60 and column 1, lines 8-11). However, the references fail to show assigning the flow-classified y CIX and DA and CIX only to a CIX prefix tree. Nonetheless, these aforementioned limitations were well known in the art at the time of the invention, as further evidenced by Brodnik.

Therefore, these would have been obvious modifications to the aforementioned method, system, and apparatus as disclosed by Ramankutty Pereira and Kaiserwerth.

In an analogous art, Brodnik shows a prefix tree employed for determining where to route IP datagrams in a networking system, (column 5, line 35 to column 6, line 15; abstract; and Figures 3-4 item 7). One of ordinary skill in the art would have been motivated to implement the prefix tree into the aforementioned TCAM ordering method, system, and apparatus so as to increase routing lookup speeds and minimize routing lookup time, and thereby increasing efficiency, (Brodnik column 3, lines 30-33).

Claims 16, 41, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty, Pereira and Kaiserwerth as applied to claims above, an further in view of Patra et al. (US Patent 6,516,383), hereinafter referred to as Patra.

In reference to claims 16, 41, and 60 Ramankutty, Pereira and Kaiserwerth show substantial features of the claimed invention. However, the references fail to show removing a flow in the TCAM by freeing up a corresponding entry in the flow index space and invalidating a corresponding TCAM entry. Nonetheless, this would have

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been an obvious modification to the method, system, and apparatus as disclosed by Ramankutty, Pereira and Kaiserwerth, as further evidenced by Patra.

In an analogous art, Patra discloses a mechanism for efficient management of free space entries by deleting entries from an index space (i.e. TCAM table) and subsequently deleting the entry located at the associated address in TCAM, (column 3, line 65 to column 4, line 4; column 4, lines 20-33; and column 5, lines 58-65). One of ordinary skill in the art would have been motivated to implement the aforementioned limitations into the TCAM ordering method, system, and apparatus so as to employ an efficient mechanism that enables rapid location and utilization of free regions in TCAM, and thereby increasing efficiency, (Patra column 3, lines 60-63).

Claims 21, 46, and 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty and Hawkinson as applied to claims above, and further in view of Patra et al. (US Patent 6,516,383) and Washburn (US Patent 6,081,440), hereinafter referred to as Patra and Washburn respectively.

In reference to claims 21, 46, and 62 Ramankutty and Hawkinson show substantial features of the claimed invention. However, the references fail to show removing a flow in the TCAM by freeing up a corresponding entry in the flow index space and invalidating a corresponding TCAM entry. Nonetheless, this would have been an obvious modification to the method, system, and apparatus as disclosed by Ramankutty and Hawkinson, as further evidenced by Patra.

In an analogous art, Patra discloses a mechanism for efficient management of free space entries by deleting entries from an index space (i.e. TCAM table) and subsequently deleting the entry located at the associated address in TCAM, (column 3, line 65 to column 4, line 4; column 4, lines 20-33; and column 5, lines 58-65). One of ordinary skill in the art would have been motivated to implement the aforementioned limitations into the TCAM ordering method, system, and apparatus so as to employ an efficient mechanism that enables rapid location and utilization of free regions in TCAM, and thereby increasing efficiency, (Patra column 3, lines 60-63). However, Ramankutty, Hawkinson, and Patra do not disclose compacting the flows in the TCAM by moving each remaining TCAM entry up by one index. Nonetheless, this limitation would have been an obvious modification to the TCAM ordering method, system, and apparatus for one of ordinary skill in the art as further evidenced by Washburn.

In an analogous art, Washburn discloses an "order delete" function in order to delete a ternary CAM location is deleted, and the CAM data values below the deleted location are shifted upward in order, (column 5, lines 28-57 and column 6, lines 57-63). One of ordinary skill in the art would have been motivated to modify the TCAM ordering, so as to reduce the time required to delete a data value stored in TCAM while maintaining the predetermined order, thereby increasing efficiency (Washburn column 5, lines 22-25).

Claims 19, 22, 44, 47, 63, and 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty and Hawkinson as applied to claims above, and further in view of Kaiserwerth et al. (US Patent 5,684,954), hereinafter referred to as Kaiserwerth.

In reference to claims 19, 22, and 63 although Ramankutty and Hawkinson disclose substantial features of the claimed invention, the references fail to show mapping the ACL flow to multiple flows in the TCAM wherein the mask for each of the multiple flows covers a portion of the range of source or destination ports for optimally determining a number of flows to cover the portion of the range. Nonetheless, this modification would have been obvious to the method, system, and apparatus as disclosed by Ramankutty and Hawkinson to one of ordinary skill in the art at the time of the invention, as further evidenced by Kaiserwerth.

In an analogous art, Kaiserwerth discloses processing various fields of a protocol header of data streams stored in CAM by mapping flows to multiple flows in the CAM wherein the mask for each of the multiple flows covers a portion of the range of source or destination ports for optimally determining a number of flows to cover the portion of the range, (column 5, line 58 to column 6, line 20 and column 8, line 20-58). This modification would have been obvious because one of ordinary skill in the art would have been so motivated to implement this modification in the aforementioned TCAM ordering method, system, and apparatus so as to provide a fast and reliable processing of addressing and connection information of data streams, thereby increasing efficiency (Kaiserwerth column 2, lines 59-61).

In reference to claim 22, 47, and 66 Ramankutty, Hawkinson, and Kaiserwerth show the claimed limitations, (Ramankutty column 2, lines 50-58; column 4, lines 19-22; and column 5, lines 40-59).

Claims 23, 48, and 67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramankutty, Hawkinson, and Kaiserwerth as applied to claims above, and further in view of Patra et al. (US Patent 6,516,383) and Washburn (US Patent 6,081,440), hereinafter referred to as Patra and Washburn respectively.

In reference to claims 23, 48, and 67 Ramankutty, Hawkinson, and Kaiserwerth show substantial features of the claimed invention. However, the references fail to show removing a flow in the TCAM by freeing up a corresponding entry in the flow index space and invalidating a corresponding TCAM entry. Nonetheless, this would have been an obvious modification to the method, system, and apparatus as disclosed by Ramankutty and Hawkinson, as further evidenced by Patra.

In an analogous art, Patra discloses a mechanism for efficient management of free space entries by deleting entries from an index space (i.e. TCAM table) and subsequently deleting the entry located at the associated address in TCAM, (column 3, line 65 to column 4, line 4; column 4, lines 20-33; and column 5, lines 58-65). One of ordinary skill in the art would have been motivated to implement the aforementioned limitations into the TCAM ordering method, system, and apparatus so as to employ an efficient mechanism that enables rapid location and utilization of free regions in TCAM,

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and thereby increasing efficiency, (Patra column 3, lines 60-63). However, Ramankutty, Hawkinson, and Patra do not disclose compacting the flows in the TCAM by moving each remaining TCAM entry up by one index. Nonetheless, this limitation would have been an obvious modification to the TCAM ordering method, system, and apparatus for one of ordinary skill in the art as further evidenced by Washburn.

In an analogous art, Washburn discloses an "order delete" function in order to delete a ternary CAM location is deleted, and the CAM data values below the deleted location are shifted upward in order, (column 5, lines 28-57 and column 6, lines 57-63). One of ordinary skill in the art would have been motivated to modify the TCAM ordering, so as to reduce the time required to delete a data value stored in TCAM while maintaining the predetermined order, thereby increasing efficiency (Washburn column 5, lines 22-25).

Allowable Subject Matter

Claims 8-13; 33-34, 36-41, and 56-57 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The claims indicate a novel and specific method, system, and apparatus for further partitioning and ordering of TCAM entries based upon Connection Index (CIX), destination address (DA), CIX only, or DA only. These limitations are not disclosed or obvious over related prior art.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

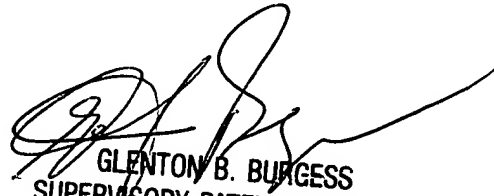
Any inquiry concerning this communication or earlier communications from the examiner should be directed to LaShanya Nash whose telephone number is (571) 272-3957. The examiner can normally be reached on 9am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton Burgess can be reached on (571) 272-3949. The fax number for the organization where this application or proceeding is assigned is (703) 746-7239.

Any inquiry of a general nature relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

LaShanya Nash
Art Unit 2153
June 10, 2005

JN


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